

## CLAIMS

### **What is claimed is:**

1. An aqueous-based preservative concentrate for use in treating lignocellulosic-based materials comprising:

- (a) a borate selected from the group consisting of ammonium borate and alkali metal borate, wherein the concentration of said borate, expressed as sodium tetraborate decahydrate equivalent, comprises at least about 15% by weight of the concentrate,
- (b) a source of metal, wherein said metal is selected from the group consisting of copper, zinc and a combination thereof, and wherein the concentration of said metal, expressed as metal oxide equivalent (CuO and/or ZnO), comprises at least about 5% by weight of the concentrate,
- (c) a volatile organic acid or salt thereof, wherein said acid has a boiling point below about 150°C, and wherein the molar ratio of the volatile organic acid to said metal in the range of about 0.1 to 0.4:1,
- (d) a source of free ammonia,
- (e) an ammonium salt,
- (f) a source of carbonate, and
- (g) water

wherein the weight ratio of the borate, expressed as sodium tetraborate decahydrate, to the metal, expressed as metal oxide, is at least 1:1, the concentration of total ammonia, including the sum of free ammonia and ammonia as ammonium salt, is at least 5% by weight of the concentrate, and wherein said concentrate has a pH greater than 8.0.

2. The preservative concentrate according to claim 1 wherein the volatile organic acid is selected from the group consisting of formic acid, acetic acid and propionic acid.

3. The preservative concentrate according to claim 1 wherein the ammonium salt is selected from the group consisting of ammonium carbonate and ammonium bicarbonate.

4. The preservative concentrate according to claim 1 wherein the source of free ammonia is selected from the group consisting of ammonia gas and ammonium hydroxide.
5. The preservative concentrate according to claim 1 wherein the borate is a sodium borate.
6. The preservative concentrate according to claim 1 wherein the borate is a sodium tetraborate decahydrate.
7. The preservative concentrate according to claim 1 wherein the source of carbonate is selected from the group consisting of carbonate salts, carbon dioxide and carbonic acid.
8. The preservative composition according to claim 1 wherein the pH of the composition is between about 9.5 and 11.5.
9. The preservative composition according to claim 1 wherein the weight ratio of the borate, expressed as sodium tetraborate decahydrate, to the metal, expressed as metal oxide, is at least about 2:1.
10. The preservative concentrate according to claim 1 wherein the metal is fully dissolved and the borate is partially dissolved and partially dispersed in the concentrate.
11. The preservative concentrate according to claim 1 wherein the source of metal is selected from the group consisting of metal carbonate, metal oxide, metal hydroxide and elemental metal.
12. The preservative concentrate according to claim 1 wherein the source of metal is selected from the group consisting of copper carbonate, zinc carbonate and zinc oxide.
13. The preservative concentrate according to claim 1 comprising about 9.8% by weight  $B_2O_3$  equivalent, about 11.8% by weight CuO equivalent and about 9.4% by weight ammonia as ammonium hydroxide.

14. The preservative concentrate according to claim 13 wherein the borate is sodium tetraborate decahydrate and the source of metal is copper carbonate.

15. A preservative wood treatment solution comprising:

- (a) a borate selected from the group consisting of ammonium borate and alkali metal borate, wherein the concentration of said borate, expressed as sodium tetraborate decahydrate equivalent, is in the range of between about 1.2 and 2% by weight of the solution,
- (b) a source of metal, wherein said metal is selected from the group consisting of copper, zinc and a combination thereof, and wherein the concentration of said metal, expressed as metal oxide equivalent (CuO and/or ZnO), is in the range of between about 0.5 and 1.5% by weight of the solution,
- (c) a volatile organic acid or salt thereof, wherein said acid has a boiling point below about 150°C, and wherein the molar ratio of the volatile organic acid to said metal in the range of about 0.1 to 0.4:1,
- (d) a source of free ammonia,
- (e) an ammonium salt,
- (f) a source of carbonate, and
- (g) water

wherein the weight ratio of the borate, expressed as sodium tetraborate decahydrate, to the metal, expressed as metal oxide, is at least 1:1, and wherein said solution has a pH greater than 8.0.

16. A preservative wood treatment solution according to claim 15 wherein the metal is copper and the concentration of copper, expressed as percent CuO is between about 0.75% and about 1.0% by weight.

17. A method for preparing the preservative concentrate according to claim 1 comprising the following steps:

- (a) add the volatile organic acid and source of free ammonia into water and mix until an integrated mixture is obtained;

- (b) add the source of metal and ammonium salt to the integrated mixture and mix until the metal is completely dissolved to form a metal-containing concentrate;
- (c) mix the borate into the metal-containing concentrate until all of the borate has dissolved or dispersed,

thereby forming the aqueous-based preservative concentrate of claim 1.

18. The method according to claim 17 wherein the borate is sodium tetraborate decahydrate.

19. The method according to claim 17 wherein the metal-containing concentrate is shipped or stored before adding the borate.

20. A method for preserving wood comprising the steps of: (a) diluting the preservative concentrate according to claim 1 with water to form a preservative treatment solution; (b) applying the treatment solution to wood such that the solution penetrates into the wood; (c) drying the wood such that there is deposited in the wood a biocidal amount of borate and a co-biocidal metal fixative.

21. The method according to claim 20 wherein the treatment solution is applied to wood using vacuum and/or pressure techniques.

22. The method according to claim 20 wherein the treated wood is kiln dried or heat treated.

23. A treated wood product produced by the method of claim 20 whereby said wood product contains a biocidal amount of borate and a co-biocidal metal fixative, thereby making the wood resistant to attack by wood destroying organisms.

24. A treated wood product according to claim 23, having an outer surface, wherein said outer surface is substantially free of surface deposits from the preservative treatment solution.